LEVEL II

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THE DEVELOPMENT AND STANDARDIZATION OF THE REVISED MOTOR VEHICLE DRIVER SELECTION BATTERY I, MDB I

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MANPOWER DEVELOPMENT AND UTILIZATION TECHNICAL AREA

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JOB

THE DEVELOPMENT AND STANDARDIZATION OF THE REVISED MOTOR VEHICLE DRIVER SELECTION BATTERY I, MDB I

BACKGROUND

The Motor Vehicle Driver Selection Battery I (MDB I) is part of the test program used to classify enlisted personnel at the time they enter the Army. It is given to new personnel who do not have a valid civilian drivers license. A passing score is required for duties which involve driving a motor vehicle. MDB I, along with the remaining testing program, is reviewed periodically to determine whether the classification system should be improved.

The current Army program for screening, selecting, training, and licensing military vehicle operators became operational in 1958 following seven years of intensive research. Unbiased validity estimates of the driver selection batteries ranged from .35 to .40.[1]

Unlike the usual civilian licensing procedures, where only the obviously unqualified are rejected and test batteries with moderate validities tend to retain many unsafe drivers, the military situation profits from more favorable selection ratios. These military personnel have already met minimum physical, visual, and psychophysical requirements; when the more highly qualified (as measured by MDB I) can be assigned to driver training and driver duties from such a large pool, the resulting percentage of safe drivers is higher than can be found in the general population.

In the process of developing the driver battery, hundreds of promising existing tests were sifted for possible use or were examined for possible research hypotheses. Research focused on the development of driving information tests, personality characteristics, attitudes, and biographical information, which were included in the final version of the driver battery.[2] Possibly because the target populations had already met minimum physical and mental requirements, the assumption that physiological and visual measures would be the most effective predictors of efficient and safe driving was not borne out.[3]

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[1] Uhlaner, J. E. Tests for selecting drivers. Paper presented at Eastern Psychological Association, March 1956.

[2] Uhlaner, J. E., Van Steenberg, N. J., and Goldstein, L. G. The construction of experimental group tests for the prediction of safe driving. ARI Research Memorandum 51-40, 1951.

[3] Goldstein, L. G., Van Steenberg, N. J., and Birnbaum, A. H. Evaluation of instruments to select safe drivers. ARI Technical Research Report 962. July 1952.

Accident records of safe drivers are generally considered unstable criteria. Consequently, a special rating of Army drivers was developed to assess behavior on the bases of the observations and the pooled judgments of supervisors and associates. Here, the rigorous procedures used in the development and refinement of predictors was applied to the criterion problem. The final criterion instrument consisted of a series of four 15-point rating scales, and a 15-item driving habit checklist. The checklist items were selected from a pool of descriptions of unsafe driving habits; experts considered these 15 items the most observable, the most ratable, and the most important for safe driving.[4]

* (Motor vehicle driver selection battery I)

OBJECTIVES

Army recruits without a valid state drivers license must obtain a passing score on the MDB* I to qualify for duties which involve driving. It is important, therefore, that the MDB I content reflect current driving skills and knowledge, and that the battery norms make accurate discriminations among the current incoming Army personnel.

The general objective of this study was to update and shorten the three tests of the MDB I: Attention to Detail, Driving-Know-How, and Self-Description Blank (Transport). The Attention to Detail Test (ATD) is a highly speeded, visual discrimination task requiring the examinee to find the number of C's embedded in a row of "O's." The problem with ATD was that the original version of ATD had to be scored by hand, which was cumbersome with the large volume of testing. The Driving-Know-How Test (DKH) is a test of safe-driving knowledge; included are topics such as how vehicles work, how to maintain vehicles, how to keep out of trouble in traffic, and rules of the road. A number of items in the original DKH were out of date due to changes in automotive technology. The Army Self-Description Blank (Transport) (SDT) covers personal experiences and opinions related to safe driving, such as disposition and experience with driving and working on cars. Changes in automotive technology rendered some of the original SDT questions obsolete.

The research was conducted in three phases. Phase I of the study was concerned with solving the immediate problem of converting the hand scored ATD test to a machine-scorable test. Phase II was directed toward internal item analyses of the SDT and DKH tests, to determine which items were out of date or no longer appropriate. Phase III entailed the standardization of the revised MDB I.

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[4] Uhlaner, J. E., Van Steenberg, N. J., and Goldstein, L. G. The development of criteria of safe driving for the individual. ARI Technical Report 935. April 1952.

PROCEDURES AND RESULTS

Because different procedures were used to accomplish the three phases of this study, each phase is discussed separately.

PHASE I: DEVELOPMENT AND TESTING OF MACHINE-SCORABLE FORMS OF THE ATTENTION TO DETAIL TEST

The Instruments. Three experimental machine-scorable forms of the ATD test were constructed as possible substitutes for the operational hand-scored ATD-1. ATD-2X is a one-page combination test and answer sheet covering 28 rows of a standard machine-scorable answer sheet. An "O" or a "C" is to be marked by the examinee; the answer spaces under the "O's" are to be left blank. The total number of "C's" (correct answers) is 260. The time limit is 4 minutes.

ATD-3X is also a one-page combination test and answer sheet. The ATD-3X contains 28 items, each having two rows of "O's" with 11 to 15 "C's" mixed in. A five-alternative answer space is positioned to the right of each item. The alternatives for each item are labeled from 11 through 15. The examinee is to count the number of C's in an item and blacken one of the five answer spaces for that item. The time limit is 4 minutes.

ATD-4X is the same as ATD-3X with one difference: The test items are in a booklet; the answer spaces are on a separate answer sheet. The answer spaces are along the right side of the answer sheet so that they can be aligned with items in the test booklet. The time limit is also 4 minutes.

Research Design and Samples. In order to determine which of the three experimental ATD tests would be the most suitable replacement for the operational ATD-1, the experimental tests were administered at the Ft. Jackson, S. C., and Ft. Knox, Ky., reception stations to samples of incoming enlisted personnel. Both test and retest data were obtained for the four ATD test forms.

The general research design is shown in Table 1. Four samples of men were used. Each sample was composed of one day's flow through both reception stations. All four samples were tested with the operational ATD-1 before any additional testing was conducted. The first sample was retested with ATD-1 on the day following the regular administration of that test; they did not take any experimental tests. The second sample took ATD-1 and ATD-2X on the same day (morning and afternoon, respectively), plus an ATD-2X retest on the following day. The third and fourth samples were tested in the same manner with ATD-3X and ATD-4X, respectively. Each sample contained about 400 men. Exact sample sizes are shown in Table 1.

Table 1

SAMPLE SIZES, MEANS, AND STANDARD DEVIATIONS OF ATTENTION TO DETAIL TEST FORMS

Sample No.	ATD Test Form	N	Mean	S.D.
1-4	ATD-1			
	First Test	1636	37.6	10.6
1	ATD-1			
	Retest	421	42.1	10.6
2	ATD-2X			
	First Test	463	177.4	38.0
	Retest		210.2	37.0
3	ATD-3X			
	First Test	365	12.2	3.5
	Retest		14.2	4.1
4	ATD-4X			
	First Test	384	11.1	3.3
	Retest		12.9	4.1

Results. Means and standard deviations of the ATD tests are shown in Table 1. Each installation was analyzed separately, but because only small differences existed between the two installations, the data were pooled. Another indication of stability or consistency of measurement is the extent to which a man will obtain the same score when retested with the same test. The test-retest reliability coefficients shown in Table 2 indicate that all four ATD test forms demonstrated a comparable level of retest reliability. Experimental ATD reliability coefficients ranged from .64 to .71; the operational ATD obtained a reliability of .66.

Table 2

ATD TEST-RETEST RELIABILITY AND CORRELATION WITH OPERATIONAL DRIVER BATTERY TESTS

Attention to Detail Test Form	Test-Retest Reliability	Correlation with Operational Driver Battery Tests[a]		
		ATD-1	DKH	SDT
Operational ATD-1	.66		.34	.30
Experimental ATD-2X	.71	.53	.26	.28
Experimental ATD-3X	.64	.45	.30	.29
Experimental ATD-4X	.69	.53	.20	.16

[a] Based on first administration of tests.

The experimental ATD forms were designed as replacements for the operational ATD-1. An indication of their efficiency as replacements can be obtained from correlations of the experimental and operational ATD forms. The second column of numbers in Table 2 shows that the ATD-2X and ATD-4X correlated highest with the ATD-1, both with r = .53. The ATD-3X correlated somewhat lower, with r = .45. Because the reliability of the ATD-1 (r = .66) serves as a reasonable ceiling for predictive validity, the figures .53 and .45 indicate that ATD-2 and ATD-4X are suitable substitutes.

To be most effective within a battery of tests, the subtests of the battery should have low intercorrelations. Low intercorrelations indicate that different types of variance are being used to predict the same thing--in this case, good drivers. The last two columns in Table 2 indicate the degree to which ATD test forms account for variance that is different from the variance of other tests in the Driver Battery--the DKH and SDT. The operational ATD-1 correlated moderately with the DKH and SDT, with r = .34 and r = .30 respectively. All of the experimental ATD tests correlated lower with the DKH and SDT, ranging from r = .16 (ATD-4X with SDT) to r = .30 (ATD-3X with DKH). Because of their generally low intercorrelation within the Driver Battery, the experimental ATD tests again showed their adequacy as substitutes for the ATD-1.

The empirical results indicated that all three experimental ATD test forms may be good substitutes for the operational ATD-1. Because ATD-3X had the lowest test-retest reliability coefficient (.64), the lowest correlation with the operational ATD-1 (.45), and the highest correlations with the DKH (.30) and SDT (.29), ATD-3X was considered less desirable than either ATD-2X or ATD-4X for operational use. ATD-2X (260 C's to be individually marked) was selected as a substitute for the ATD-1 in the Driver Battery; ATD-4X (28 problems with a separate answer sheet) was selected for use in the new version of the Army Classification Battery (ACB). To eliminate future confusion between the two selected experimental ATD test forms, the Driver Battery version was renamed the Army Vigilance Test (VIG-1); the ACB version of ATD is called the Attention to Detail Test (AD).

PHASE II: INTERNAL ITEM ANALYSES OF THE OPERATIONAL DKH-2 AND SDT-1

Method and Results. Operational DKH-2 and SDT-1 answer sheets from a total of 4500 men at four installations were obtained for analysis. The installations were Fort Dix, N. J., Fort Leonard Wood, Mo., Fort Polk, La., and Fort Ord, Calif.

Item analyses provided P values and biserial correlation coefficients between item alternative and total test score. Items that had P values between .10 and .90, and whose biserial correlation coefficients of the correct alternative were +.25 or higher, were retained. Items out of date (because of advances in automotive technology) were either altered or dropped. DKH was reduced from 48 to 36 items, and the SDT from 130 to 70 items. Internal consistency of the original and revised DKH and SDT was computed using the KR-21 formula. The shortened DKH had the same reliability as the original, .82, while the shortened SDT had a slightly lower reliability--.80 vs .85 for the longer version.

PHASE III: STANDARDIZATION OF THE REVISED MDB I

The Instrument. As a result of Phases I and II, a new experimental instrument was constructed--the Army Motor Vehicle Driver Selection Battery IX (MDB IX). The newly revised Driving-Know-How Test (DKH), Self Description Blank (Transport) (SDT), and Vigilance Test (VIG--the ATD-2X renamed) are contained in a single test booklet, with a single separate answer sheet. Table 3 shows comparison of the operational MDB I and the experimental MDB IX subtests. Table 4 shows means, standard deviations, and intercorrelation coefficients of the subtest. Total administration time for the MDB IX, including distribution of materials, reading instructions, and practice questions, is about one hour.

Table 3

CHARACTERISTICS OF ORIGINAL OPERATIONAL MDB 1 SUBTESTS
AND EXPERIMENTAL MDB 1X SUBTESTS

MDB Component Tests	Testing Time (Min)		Number of Items		Item Types		Maximum Raw Score[a]		KR-21 Reliability	
	Oper.	Exp.	Oper.	Exp.	Oper.	Exp.	Oper.	Exp.	Oper.	Exp.
DKH	20	15	48	36	4-choice	4-choice	48	36	.82	.82
SDT	60	20	130	70	Various	Yes/No	130	70	.85	.80
VIC	4	4	60	260	5-choice	2-choice	60	26[b]		
AGE	-	-	-	-	-	-	30	30		
Total	84[c]	39[c]	-	-	-	-	268	162		

[a] Rights-only

[b] Raw score recorded as first two digits of total correct item count.

[c] Total testing time, including distributing materials, reading instructions and practice questions, was just under 2 hours for the operational MDB 1, and about 1 hour for the MDB 1X.

Table 4

MEANS, STANDARD DEVIATIONS, AND
INTERCORRELATIONS OF MDB IX COMPONENT TESTS
(N = 2512)

MDB IX Component Tests	Mean	S.D.	Intercorrelations DKH	SDT	VIG	AGE
DKH	23.8	6.3	–	.56	.27	.21
SDT	49.2	8.4		–	.19	.26
VIG	16.7	4.6			–	.15
Age	19.8	2.0				–
Total MDB IX	109	14				

Note. Based on raw score data used for standardization.

An MDB IX total raw score is generated for each examinee by adding the raw scores of the DKH, SDT, and VIG to the age (in years) of the examinee. To bring the range and variability of the VIG score in line with other MDB IX test scores, the VIG raw score is designated as the first two digits of the total number of correct answers. For example, 158 correct answers on the VIG Test would result in a VIG raw score of 15. Because there are 260 VIG items, the maximum obtainable VIG raw score is 26. The maximum score for age is set at 30 years. The maximum possible raw score for the MDB IX is 162.

Standardization Samples and Procedures. The MDB IX was administered to about 600 enlisted personnel at each of four reception stations: Fort Dix, N. J., Fort Jackson, S. C., Fort Knox, Ky., and Fort Ord, Calif. Data from the four reception stations were pooled to provide a distribution of MDB IX scores.

Because the standardization sample came from reception stations, only those persons who scored above the 10th percentile on the Armed Forces Qualification Test (AFQT) were represented in the distribution of MDB IX raw scores. The obtained distribution was representative of Army enlisted personnel above the 10th percentile. Persons who score below the 10th percentile on AFQT are not eligible for military service, but are included in the norm population for Army Standard Scores.

A procedure for correcting for the selection effect of AFQT was used to produce an adjusted distribution of MDB 1X scores. The adjustment procedure was based on the correlation of the Driver Battery with AFQT. The correlation of MDB and AFQT was .51; r = .50 was used in the adjustment procedure.

As the final step in the standardization procedure, the adjusted distribution of MDB 1X scores was converted to Army Standard Scores (mean of 100, standard deviation of 20) using a conversion table based on the Army population. Table 5 shows the final conversion of MDB 1X raw scores to Army Standard Scores.

SUMMARY AND CONCLUSIONS

The MDB 1 is administered to Army recruits who do not possess a valid state drivers license. The DKH and SDT subtests contained questions that were outdated because of changes in automotive technology. A third subtest (ATD) was modified for machine scoring.

Internal item analyses resulted in streamlined versions of the DKH and SDT. The DKH was reduced from 48 to 36 items, and the SDT was reduced from 130 to 70 items. A new version of the ATD (renamed the Vigilance Test, VIG) proved to be a good machine-scorable substitute for the operational ATD-1. The number of answer sheets for the Driver Battery was reduced from three (two machine-scored and one hand-scored) to one (DKH and SDT on one side; VIG on the reverse side). All three tests were contained in one test booklet, in contrast to the separate booklets used for the operational ATD-1. Total testing time was cut in half.

The newly revised tests, plus a score based on age, formed an experimental Driver Battery MDB 1X, which was administered at representative reception stations throughout the continental U.S. The MDB 1X is easier to administer because it features consolidated testing materials, takes less time and eliminates cumbersome scoring procedures. The revised MDB 1 makes useful discriminations throughout the score range.

On the basis of the above research, a revised version of the MDB 1 was prepared for implementation and was implemented 1 July 1973.

With the expansion of civilian driver training courses in recent years, most current recruits possess valid drivers licenses and thus do not take the MDB 1. The MDB 1 is a better selector of safe drivers than many civilian driving tests, however; perhaps it should be used more.

Table 5

CONVERSION OF RAW SCORES TO ARMY STANDARD SCORES
FOR THE ARMY MOTOR VEHICLE DRIVER SELECTION BATTERY
BATTERY 1
(N = 2512)

Raw Score	Standard Score	Raw Score	Standard Score	Raw Score	Standard Score
Above 150	160				
150	160				
149	159	119	115	89	69
148	158	118	114	88	68
147	157	117	112	87	67
146	156	116	110	86	66
145	155	115	109	85	65
144	154	114	107	84	64
143	153	113	105	83	63
142	152	112	104	82	62
141	151	111	102	81	61
140	150	110	100	80	60
139	149	109	99	79	59
138	147	108	97	78	58
137	145	107	96	77	57
136	144	106	94	76	56
135	142	105	93	75	55
134	140	104	91	74	54
133	139	103	90	73	53
132	137	102	88	72	52
131	135	101	87	71	51
130	134	100	85	70	50
129	132	99	84	69	49
128	130	98	82	68	48
127	129	97	81	67	47
126	127	96	79	66	46
125	125	95	78	65	45
124	124	94	76	64	44
123	122	93	75	63	43
122	120	92	73	62	42
121	119	91	72	61	41
120	117	90	70	60	40
				Below 60	40

Note. Derived from standardization data gathered on MDB IX in 1971.